**Enthalpy & Enthalpy Change**

**Energy in a molecule**

**P\_\_\_\_\_\_\_\_\_ Energy**

**1. Intermolecular potential energy**

- weak electrostatic forces of attraction between molecules

**2. Intramolecular potential energy**

- strong electrostatic interactions within a molecule

- chemical bond

- 40-1300 kJ/mole

**3. Nuclear potential energy**

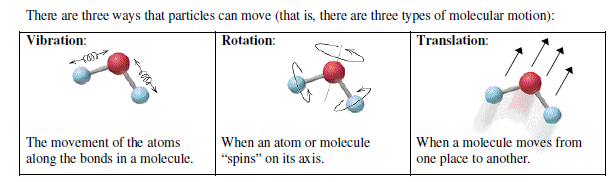
- very strong forces that hold protons and neutrons together

- highest energie:

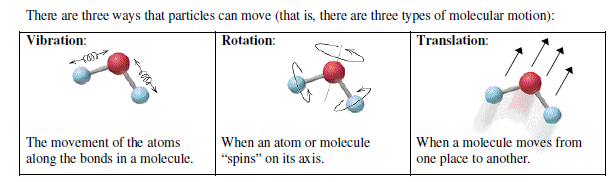
4x 10**6** kJ/mole

**K\_\_\_\_\_\_\_\_\_ Energy**

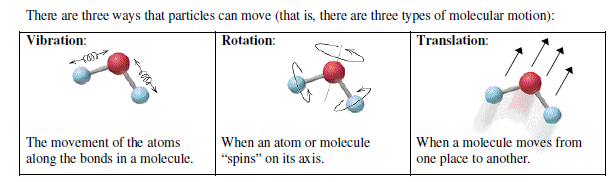
1. V



2. R



3. T



Q. Identify types of potential energy

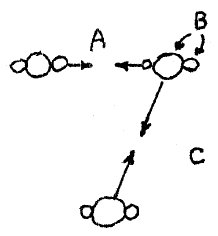
i) intermolecular attraction

ii) intramolecular attraction

iii) interaction of highest PE

iv) interaction of lowest PE

v) strongest force of attraction



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| **Enthalpy H** | **Enthalpy ChangeΔH** |
| = the total internal energy , both Kinetic & potential its molecules have  H = E + PV  • impossible to \_\_\_\_\_\_\_\_\_\_\_\_\_\_ | * = the change in enthalpy of a system * • Symbol: **ΔH**   Hfinal = Efinal + (PV)final  Hinitial = Einitial + (PV) initial  ΔH = ΔE + Δ(PV)   * • **ΔH**  \_\_\_\_\_\_ be measured   • For rxn of solids and liquids, we assume \_\_\_\_\_\_\_\_ change in P and V  **🡪 Δ(PV) = \_\_\_\_\_\_\_ and ΔH = \_\_\_\_\_\_**   * • **ΔH**  depends ONLY on the initial and final state (condition) of the system 🡪 a property we call “state function” * **D:\Kipling 2016\SCH4U\3. Thermodynamics\state function.jpg**   • A **state function** is a property whose value does not depend on the path taken to reach that specific value.  • Atmospheric pressure usually chosen with enthalpy because it’s easy to \_\_\_\_\_\_\_\_   * **STP = 101.3kPa & 273K (0°C)** * **SATP = 100kPa & 298K (25°C)** |

**Representing Enthalpy Changes**

***Method 1:*** **Thermochemical Equations with Energy Terms**

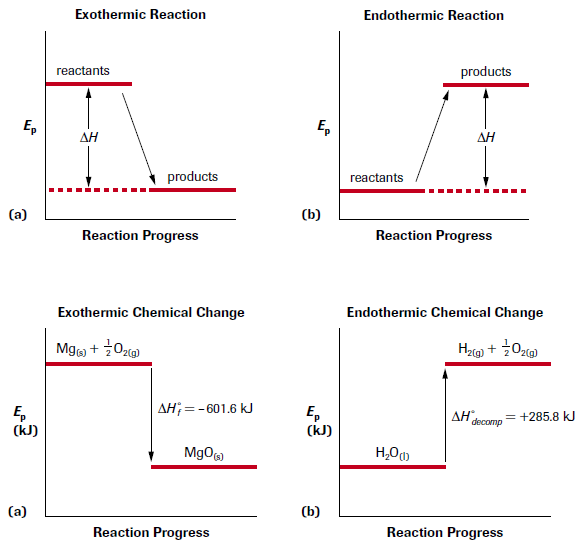
H2O(l) + 285.8 kJ → H2(g) + ½ O2(g) *Endothermic Reactions:* energy term is on the\_\_\_\_\_\_\_\_\_\_\_ side

Mg(s) + ½ O2(g)  → MgO(s) + 601.6 kJ *Exothermic Reactions*: energy term is on the \_\_\_\_\_\_\_\_\_\_\_\_side

***Method 2:*** **Thermochemical Equations with ∆H values**

H2O(l) → H2(g) + ½ O2(g) ∆H = 285.8 kJ *Endothermic reaction* (heat is absorbed), ∆H \_\_\_\_ 0

Mg(s) + ½ O2(g)  → MgO(s) ∆H = - 601.6 kJ  *Exothermic reaction* (heat is released), ∆H \_\_\_\_\_0

***Method 3:*** **Potential Energy Diagram (also see the two examples above)**

* The vertical axis on the diagram represents the potential energy (PE) of the system.
* The horizontal axis is a reaction coordinate or reaction progress.
* The reactants are written on the left and the products on the right
* Exothermic change: the products have less PE than the reactants, energy is released to the surroundings
* Endothermic change: the products have more PE than the reactants: energy is absorbed from the surrounding

**Notation with ΔH**

|  |  |
| --- | --- |
| Method 1: | Method 2: |
| 1. ½ N2(g) + ½ 02(g) ---> NO(g) ΔH = 90.3 kJ | 1. CO(g) + H2(g) + O2(g) ---> CO2(g) + H2O(g) + 522 kJ |
| Type of reaction: 🞎 endo 🞎 exo | Type of reaction: 🞎 endo 🞎 exo |
| Rewrite equation A above using **method 2** | Rewrite equation B above using **method 1** |
| Draw an enthalpy diagram for reaction A | Draw an enthalpy diagram for reaction B |